

IEM's AI Modeling: Short-term COVID-19 Projections

Date: 6/8/21

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 6/8/21 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

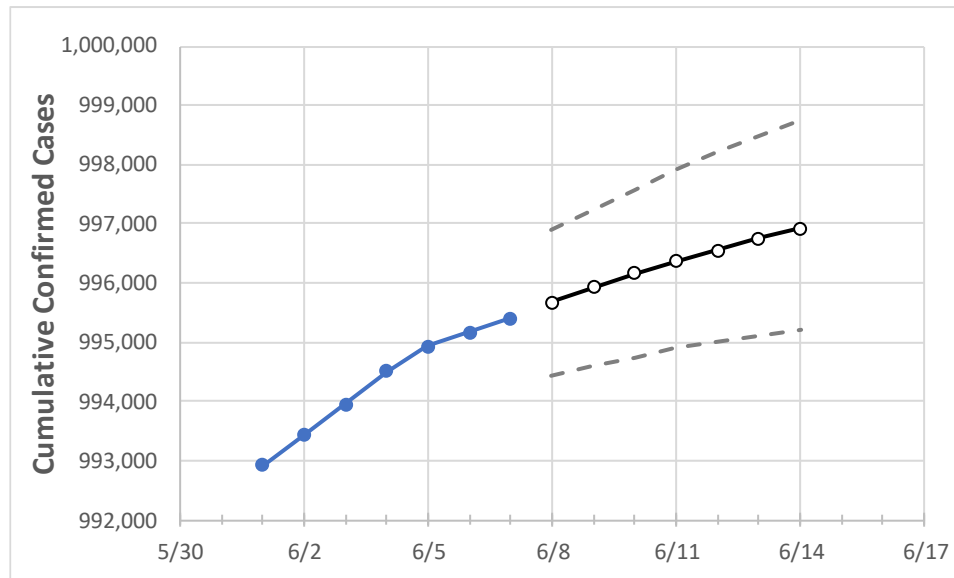
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

Michigan State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14
Michigan	994,506	994,935	995,166	995,397	995,670	995,922	996,158	996,361	996,551	996,746	996,919

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

Michigan Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14
Genesee	41,635	41,643	41,649	41,655	41,661	41,667	41,673	41,678	41,683	41,687	41,691
Ingham	24,789	24,795	24,802	24,808	24,814	24,820	24,826	24,831	24,835	24,840	24,844
Kent	72,925	72,967	72,992	73,016	73,037	73,057	73,074	73,090	73,105	73,119	73,131
Livingston	16,659	16,668	16,672	16,676	16,680	16,684	16,687	16,691	16,694	16,697	16,699
Macomb	99,785	99,816	99,840	99,864	99,886	99,907	99,927	99,945	99,960	99,976	99,990
Monroe	15,356	15,361	15,365	15,369	15,373	15,377	15,380	15,384	15,387	15,389	15,392
Oakland	118,114	118,174	118,198	118,221	118,259	118,294	118,328	118,360	118,390	118,418	118,442
Washtenaw	26,402	26,404	26,408	26,412	26,415	26,417	26,420	26,422	26,424	26,426	26,427
Wayne	164,691	164,769	164,815	164,860	164,915	164,967	165,016	165,061	165,105	165,145	165,182

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- **Beds:** For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report ([MMWR, March 18, 2020](#)) and state reports of COVID-19 cases.
- **ICU:** The CDC report found that 24% of hospitalized cases require ICU care.
- **Ventilators:** Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.

Michigan Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:											
	6/4	6/5	6/6	6/7	6/9				6/11				6/13			
Genesee	41,635	41,643	41,649	41,655	41,667	(8,333)	[2,000]	{1,000}	41,678	(8,336)	[2,001]	{1,000}	41,687	(8,337)	[2,001]	{1,000}
Ingham	24,789	24,795	24,802	24,808	24,820	(4,964)	[1,191]	{596}	24,831	(4,966)	[1,192]	{596}	24,840	(4,968)	[1,192]	{596}
Kent	72,925	72,967	72,992	73,016	73,057	(14,611)	[3,507]	{1,753}	73,090	(14,618)	[3,508]	{1,754}	73,119	(14,624)	[3,510]	{1,755}
Livingston	16,659	16,668	16,672	16,676	16,684	(3,337)	[801]	{400}	16,691	(3,338)	[801]	{401}	16,697	(3,339)	[801]	{401}
Macomb	99,785	99,816	99,840	99,864	99,907	(19,981)	[4,796]	{2,398}	99,945	(19,989)	[4,797]	{2,399}	99,976	(19,995)	[4,799]	{2,399}
Monroe	15,356	15,361	15,365	15,369	15,377	(3,075)	[738]	{369}	15,384	(3,077)	[738]	{369}	15,389	(3,078)	[739]	{369}
Oakland	118,114	118,174	118,198	118,221	118,294	(23,659)	[5,678]	{2,839}	118,360	(23,672)	[5,681]	{2,841}	118,418	(23,684)	[5,684]	{2,842}
Washtenaw	26,402	26,404	26,408	26,412	26,417	(5,283)	[1,268]	{634}	26,422	(5,284)	[1,268]	{634}	26,426	(5,285)	[1,268]	{634}
Wayne	164,691	164,769	164,815	164,860	164,967	(32,993)	[7,918]	{3,959}	165,061	(33,012)	[7,923]	{3,961}	165,145	(33,029)	[7,927]	{3,963}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.